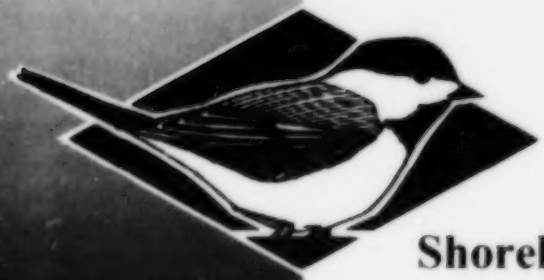

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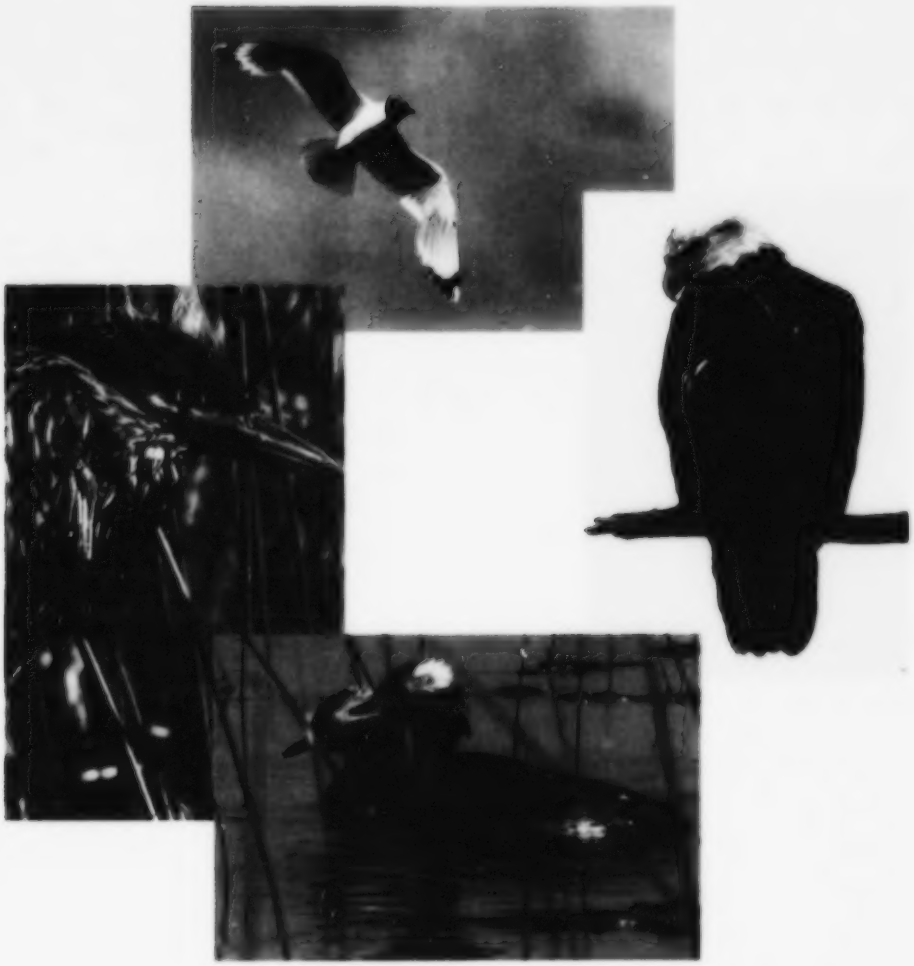

Alberta Species at Risk Report No. 115

Alberta

Bird Populations on the Shoreline of Buffalo Lake: Identification of Priority Areas for Conservation

David R. C. Prescott and Scott D. Stevens

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EXECUTIVE SUMMARY

Buffalo Lake is one of the largest lakes in central Alberta. The lake has been recognized by numerous authorities as being important for wildlife, and most notably for breeding waterbirds. Following stabilization of lake levels in the 1990s, and a thriving local economy, the lake is becoming increasingly popular for recreational and other developments. Several planning exercises are underway that will guide development and land use around Buffalo Lake in the future. In 2007, Alberta Fish and Wildlife Division, with support from local partners, conducted a comprehensive survey of bird species around Buffalo Lake. The goal was to prioritize shoreline areas based on the abundance and relative conservation importance of avian species around the lake, and to highlight areas where the protection of important bird habitats should be incorporated into land-use decisions.

A total of 687 circular point counts (100 m in radius, 6-min in duration) were completed around the entire shoreline of Buffalo Lake between 29 May and 30 June. Counts were centered on the shoreline of the lake, with half of each count sampling areas covered by water (including emergent vegetation), and the remaining half sampling upland habitats. Each count was assigned a value according to a formula that incorporated the abundance of each species observed in a count, and the risk of extirpation of each species in the province as determined by the *General Status of Alberta Wild Species 2005*. Values for counts were then divided into LOW (42.1% of counts), MEDIUM (36.2%), HIGH (16.4%) or VERY HIGH (5.2%) classes, reflecting the conservation value of each segment of shoreline around the lake.

A total of 125 species of birds were detected during point counts, and an additional 20 species of birds were encountered during other activities on the lake. Thirty of these species were classified being of "Sensitive" status in Alberta; no species of higher risk status ("At Risk" or "May be at Risk") were present in 2007. The resulting areas of HIGH or VERY HIGH conservation value were therefore heavily influenced by the distribution of "Sensitive" species, and occurred particularly where concentrations of such species occurred. These areas included the western parts of Secondary Bay, areas around Parlby Bay and the Narrows, emergent vegetation offshore from Scenic Sands, Bird Island, areas around the entrance and north end of Foreleg Bay, portions of Bashaw Bay, and the basin between Bashaw Bay and Foreleg Bay. These areas included significant colonies of several "Sensitive" species including Horned Grebes, Western Grebes, American White Pelicans, Great Blue Herons, Black-crowned Night-Herons, Forster's Terns and Black Terns, as well as significant aggregations of "Secure" species such as California Gulls, Franklin's Gulls, Ring-billed Gulls, Eared Grebes, Double-crested Cormorants, and Marsh Wrens.

Water levels on Buffalo Lake were unusually high in 2007, but comparisons with historical records suggest that many of the high-priority areas are consistent across years. However, some species shift their distributions from year to year, and continued study of Buffalo Lake in other years, and during different times of the year are needed to fully assess the value of shoreline habitats to birds.

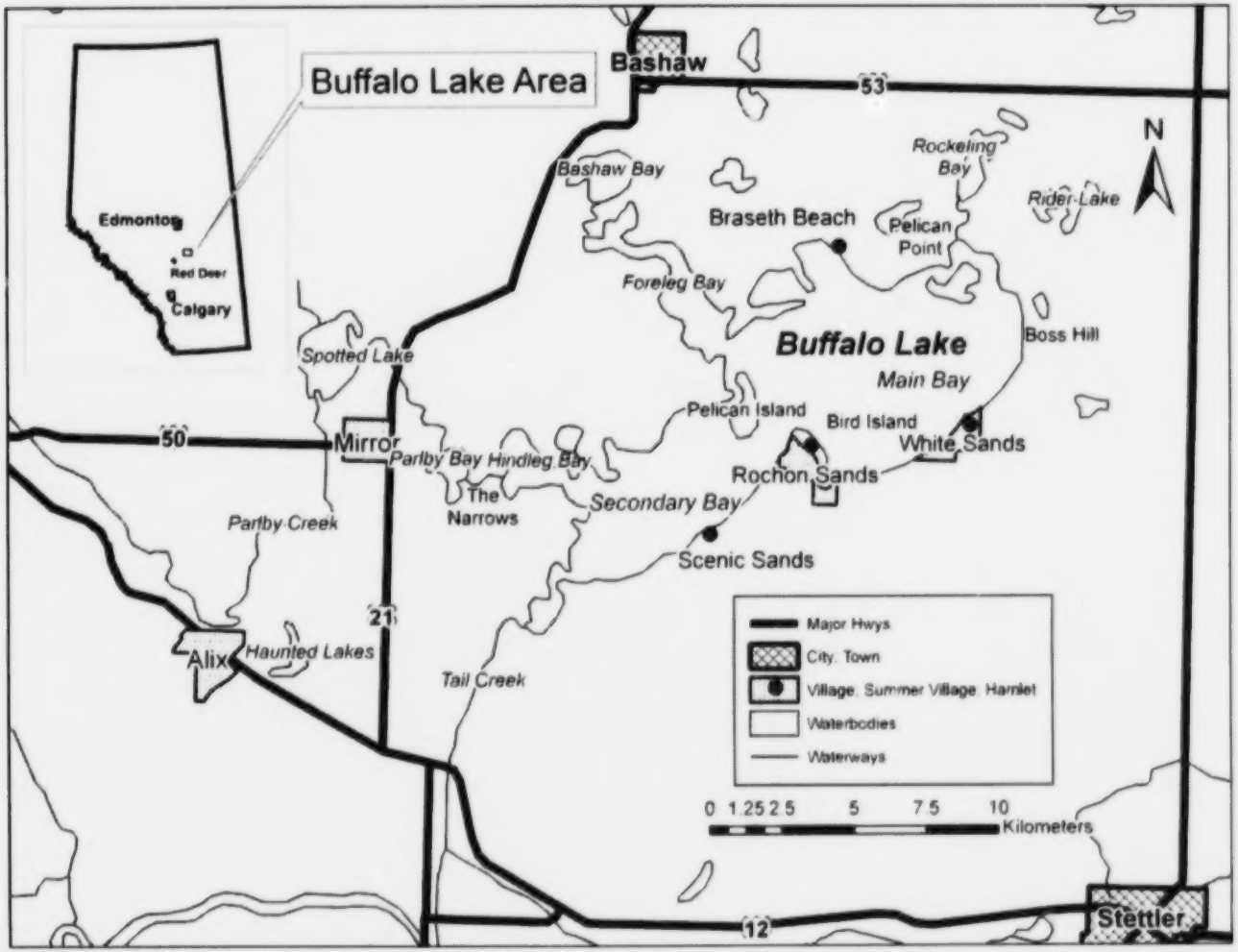
INTRODUCTION

Buffalo Lake (Figure 1) is among the largest lakes in central Alberta (approximately 93.5 km^2; Mitchell and Prepas 1990), with shoreline perimeter of about 100 km. The lake is situated in the Aspen Parkland Ecoregion (Strong and Leggat 1991), and is surrounded by a mix of agricultural, industrial (primarily oil and gas extraction and processing), residential and recreational developments. Historically, Buffalo Lake experienced widely fluctuating water levels (Mitchell and Prepas 1990). In the 1970s, public interest in stabilizing lake levels to increase recreational opportunities became evident. This led to a series of engineering and impact assessments (see Environmental Management Associates 1991) that culminated in the completion, in 1995, of a project to pump water from the Red Deer River into the lake. This project was designed not only to stabilize the levels of Buffalo Lake, but to provide agricultural flood control, water supply for nearby municipalities, and the enhancement of fish and wildlife habitat (Gray et al. 1992). Lake stabilization and a thriving local economy have subsequently led to the acceleration of development on shorelines and adjacent areas in recent years.

Buffalo Lake has frequently been acknowledged for its importance to wildlife, and in particular, to birds. This recognition stems mainly from its value as a waterfowl production and staging area, and because of the presence of several large colonies of colonial waterbirds (Mitchell and Prepas 1990, Poston et al. 1990, Environmental Management Associates 1991, Bjorge 1992, Gray et al. 1992, Cottonwood Consultants 2000, Beyersbergen et al. 2004). The importance of the lake to other species of breeding birds has been poorly investigated (Environmental Management Associates 1991). This is despite the known richness of breeding species in the area (Semenchuk 1992), as well as the documented presence of several "at risk" ("Endangered", "Threatened" or "Special Concern") species around the lake (Alberta Fish and Wildlife Division, unpubl. data).

The lands around the lake (up to the 1-in-100 year flood line) are managed by Alberta Public Lands and Forests Division, which is currently leading a multi-agency team to determine the long-term management of these shorelines. Land-use planning is also being initiated by the Counties of Lacombe, Stettler and Camrose for areas around the lake. These exercises will have important influence on the availability and quality of wildlife habitat around Buffalo Lake, and the persistence of several species of high conservation importance. In 2007, Alberta Fish and Wildlife Division, with support from local partners, undertook a study to quantify the importance of shoreline areas of Buffalo Lake to avian species. This project, reported herein, aimed to prioritize shoreline areas based on the abundance and relative conservation importance of avian species around the lake, and to highlight areas where the conservation of important bird habitats should be incorporated into land-use decisions.

Figure 1. Map of Buffalo Lake and area.



METHODS

Birds were surveyed in the spring and summer of 2007 using circular point counts (see Ralph et al. 1995 for general methodology) with a radius of 100 m positioned along the shoreline of the lake. Sample points were pre-selected, using 1999 colour imagery (1 m resolution) of Buffalo Lake and then converting paths to points using Hawth Tools in ArcGIS 9.1. Points (n=931) were generated at 200 m intervals along the shoreline. The positioning of the count centres meant that on average, half of each count should sample areas covered by water (including emergent vegetation), with the remaining half sampling the upland habitats. In areas where the shoreline was highly irregular, the radii around pre-selected points often overlapped. If this overlap was >30%, certain points were deleted or rearranged to eliminate or reduce overlap between adjacent count circles. Points were added in a few areas where the digital polygon did not accurately represent the shoreline of the lake (generally islands and large patches of emergent vegetation in off-shore areas). The count circles were intended to sample, more or less, the shoreline buffer representing the 1-in-100-year high water mark that is managed by Alberta Public Lands as part of the Buffalo Lake water management project. The location of points also sampled areas (main basin and selected adjacent basins) that are under consideration for planning by the Buffalo Lake Integrated Shoreline Management Plan (BLISMP) initiative.

The geographical coordinates (decimal degrees, NAD 83) of all planned sample points were pre-loaded into GPS receivers (Garmin Map 60CSx, 76CS or 76CSx) to facilitate navigation in the field. Points were then accessed by foot or watercraft (14' aluminum boat with 25 hp outboard motor, canoe or kayak), depending on shoreline characteristics and logistics of access. Counters worked alone or in pairs, depending on their skill level, with members of pairs being varied to ensure consistency of count methodology. We arbitrarily began censuses on the eastern shore of the lake with the intention of working in a westerly direction. However, areas targeted for survey on different days were often determined by prevailing winds, so that counts were conducted on leeward shores whenever possible. Counts were generally conducted between 0600 and 1100h, during rainless periods when winds were <20 km/h and temperatures <20°C. Each count lasted for six minutes, during which all species seen or heard within the count circle were tallied. Birds flying through the count area that appeared not to be using habitats within the circle for any purpose were ignored. We also deleted species known to be migrants through the area. In general, we counted only birds seen or heard within the prescribed distance while standing at the point centre. However, we counted birds flushing out of circles as the observer approached the count center, if it was believed that proximity of the observer caused the birds to flee.

Segments of shoreline (i.e. 200 m units) around the lake were classified based on the number of species detected in each circle, in combination with their abundance and apparent risk status. The latter value was derived from status ratings determined by the *General Status of Alberta Wild Species 2005* (Alberta Sustainable Resource Development 2007), which rates all species of birds (and other wildlife and plants) based on their expected risk of extirpation in the province. In this system, species are evaluated on

factors such as their current abundance and population size in the province, trend in population size and distribution, and threats to populations and habitats. Each species is then classified into one of the following groups which reflect their priority to wildlife managers: "Alien/Exotic", "Secure", "Sensitive", "May be at Risk", or "At Risk" (other minor categories are defined, but omitted here). We assigned numerical values of 1, 10, 100, 1000 and 10,000, respectively, to species in these categories, and derived a total score for each count by calculating the product of abundance and status score for each species, and summing these products over all species observed in a count. For example, a count where we observed two House Sparrows (status "Alien/Exotic"; score=1), 10 Red-winged Blackbirds (status "Secure"; score =10), and two Horned Grebes (status "Sensitive"; score=100) would have an overall score of (2*1)+(10*10)+(2*100) = 302. Based on the range of scores calculated over all counts on the lake, we later divided up the counts into VERY HIGH, HIGH, MEDIUM and LOW importance, such that no less than 40% of counts fell into the LOW category, and no more than 5% of scores fell into the VERY HIGH category.

Count circles of 100-m radius can not detect the full suite of species using habitats around Buffalo Lake. For example, rare or uncommon species may occasionally be detected only when traveling between points, or while performing other tasks around the lake (general reconnaissance, visits to landowners, etc.). We compiled observations of all bird species seen within 2 km of the shoreline of the lake using classification of *The Atlas of Breeding Birds of Alberta* (Semenchuk 1992). Classes of observation included "migrant" (birds seen in the area, but considered to be *en route* to or from breeding areas distant from Buffalo Lake), "possible" breeders (observed in suitable breeding habitat at times when breeding is likely to occur), "probable" breeders (observations of paired or territorial birds, courtship behavior, or behaviors suggesting the presence of an unseen nest), and "confirmed" breeders (birds observed with nests, eggs or young, or seen carrying food or faecal sacs). We also documented the location of significant colonies of waterbirds and other species in cases where these aggregations were not positioned within count circles. Observations of mammals, amphibians and reptiles were recorded when encountered.

RESULTS

Substantial winter snowfall and spring rains meant that water levels on Buffalo Lake in 2007 were higher than in recent years. These conditions meant that many of the pre-determined count centers were in shallow water, rather than being on the edge of dry ground as intended. Nevertheless, we conducted surveys from these points, but recognized that this placement may have biased bird counts towards aquatic and semi-aquatic species, and underrepresented the abundance of land birds within 100 m of the "normal" lake edge.

Five different observers participated in the completion of 687 counts on 25 days between 29 May and 30 June 2007. These observers completed a mean of 27.48 $\pm$ 1.74 (SE) counts/day (range: 10-41). All but 33 (4.8%) of the counts were conducted before 1100

h. Only seven counts (1.0%) were completed after 1200 h, and all of these were conducted during the first two field days of the study (29 May and 1 June), when birds were highly active and observable.

A total of 125 species were encountered during point counts. This total includes only species that were likely to breed in the area, with 55.2% considered to be "confirmed" breeders, 20.8% being "probable" breeders, and 24.0% being "possible" breeding species (Appendix 1). Two species, the Sandhill Crane (1 count) and Herring Gull (2 counts), are not known to breed in the Buffalo Lake area. However, these species were retained in the point count database because suitable habitat for breeding occurs on the lake, and breeding activity can not be ruled out due to the proximity of Buffalo Lake to known summer ranges of these species (Semenchuk 1992). Even if breeding did not occur, both of these species were uncommon, and would have contributed little to the overall rating of counts on the lake. The mean number of species per count was 12.30 $\pm$ 0.12 (range: 2-22), with the mean number of individuals being 31.71 $\pm$ 1.85 (range: 6-828) per count.

The top 20 species in terms of frequency of encounters and mean abundance per count are shown in Table 1, with values for all species encountered shown in Appendix 1. The most frequently encountered species were Red-winged Blackbirds (66.1% of counts), followed by American Coots (60.6%) and Clay-colored Sparrows (59.5%). Red-winged Blackbirds also had the highest abundance per count of any species (2.20), followed by Black Terns (2.04) and Franklin's Gulls (1.98).

Table 1. Top 20 species in terms of their frequency of occurrence and mean abundance in point counts (n=687) along the shoreline of Buffalo Lake, 2007. See Appendix 1 for complete listing.

Frequency of Counts (%)	Mean Abundance per Count
Red-winged Blackbird (66.1)	Red-winged Blackbird (2.20)
American Coot (60.6)	Black Tern (2.04)
Clay-colored Sparrow (59.5)	Franklin's Gull (1.98)
Savannah Sparrow (55.3)	California Gull (1.75)
House Wren (48.5)	Yellow-headed Blackbird (1.38)
Yellow Warbler (48.0)	American Coot (1.19)
Yellow-headed Blackbird (39.0)	Savannah Sparrow (1.19)
Blue-winged Teal (38.4)	Blue-winged Teal (1.15)
Red-necked Grebe (38.0)	Forster's Tern (1.14)
Black Tern (37.6)	Clay-colored Sparrow (1.11)
Tree Swallow (35.7)	Eared Grebe (1.08)
Mallard (34.8)	Mallard (1.08)
Least Flycatcher (32.6)	Red-necked Grebe (0.98)
American Crow (28.4)	House Wren (0.91)
Forster's Tern (25.9)	American White Pelican (0.80)
Sora (24.3)	Tree Swallow (0.78)
Gadwall (24.2)	Yellow Warbler (0.77)
Warbling Vireo (22.7)	Gadwall (0.55)
Wilson's Snipe (21.5)	Least Flycatcher (0.51)
American Robin (21.4)	American Crow (0.50)

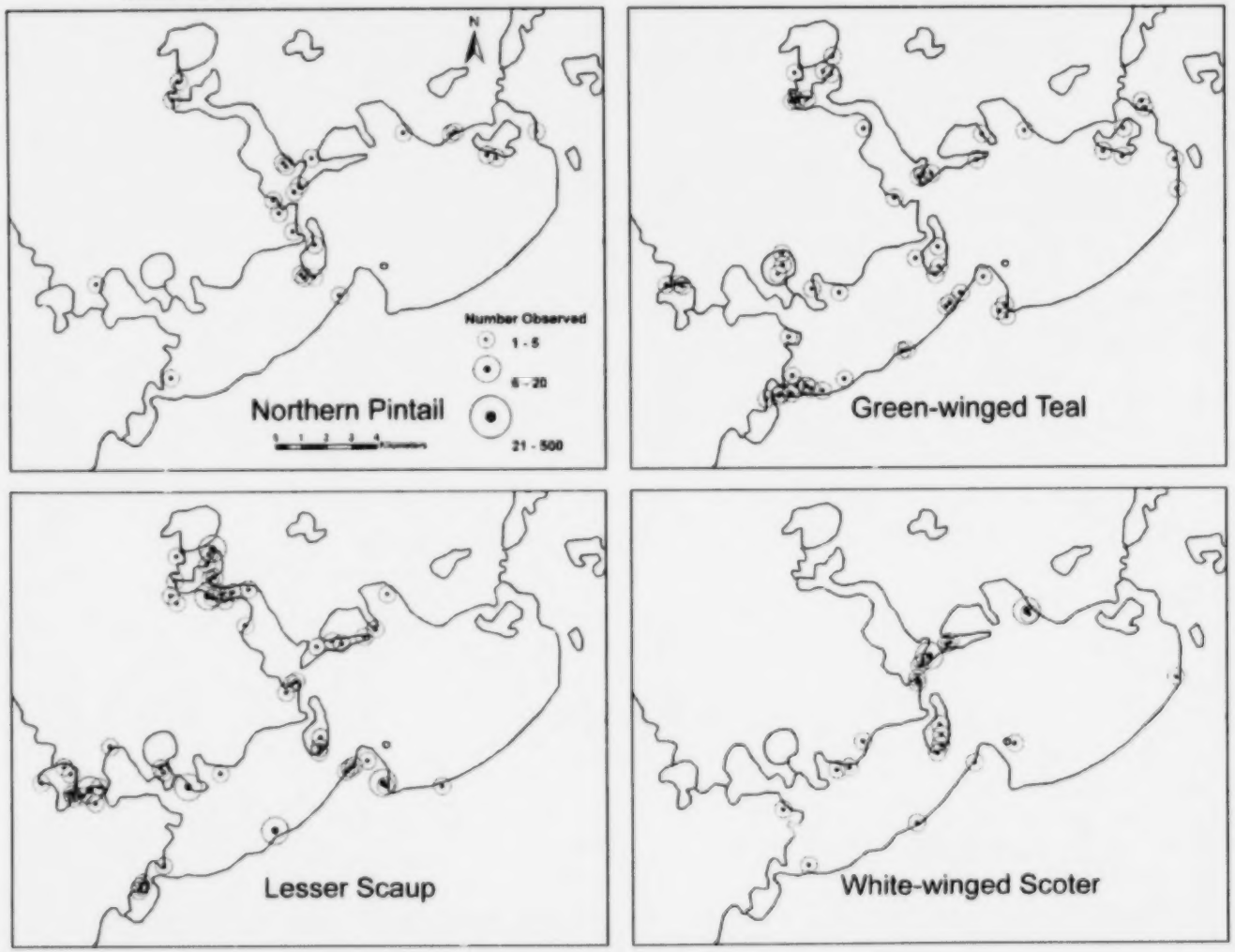
The majority (73.6%) of the 125 species encountered during point counts are currently listed as being of "Secure" status in Alberta (Appendix 1). A total of 30 species (24.0%) are currently listed as being "Sensitive", with three species (2.4% being considered to be "Alien/Exotics"). There were no species found during point counts in 2007 that are currently considered to be "May be At Risk" or "At Risk" in Alberta. The distributions of sensitive species on the lake are shown in Figure 2. Many species were relatively uncommon and sporadic in occurrence (11 species were found in four counts or less). Other species were very common on certain areas of the lake (e.g., colonial waterbirds such as Western Grebe, American White Pelican, Black-crowned Night-Heron, Forster's Tern and Black Tern); whereas others occurred frequently, but at low abundance around much of the lake (e.g. Sora, Least Flycatcher and Baltimore Oriole). In general, most concentrations of "Sensitive" species occurred on the western and northern areas of the lake. This is also true of six species of colonial waterbirds that are currently listed as "Secure" in Alberta (Figure 3). These species (Ring-billed, Franklin's and California Gulls, Eared Grebes, Double-crested Cormorants and Marsh Wrens) occur in significant concentrations on Buffalo Lake.

Classification of point counts based on the species present and their risk status resulted in scores ranging from 60 to 31050. These scores were grouped into priority classes as follows: LOW (scores<500; 42.1% of counts), MEDIUM (scores of 500-999; 36.2% of counts), HIGH (scores of 1000-1999; 16.4% of counts) and VERY HIGH (scores $\geq$2000; 5.2% of scores). Given the importance of "Sensitive" species in calculating scores, it follows that most areas of the HIGH and VERY HIGH importance occurred on the western and northern parts of Buffalo Lake (Figure 4). The highest ratings occurred in areas with large aggregations of colonial waterbirds, and especially areas where concentrations of several species occur in the same areas. These include the western parts of Secondary Bay (see Figure 1 for descriptions), areas around Parlby Bay and the Narrows, the emergent vegetation offshore from Scenic Sands, Bird Island, areas around the entrance and north end of Foreleg Bay, portions of Bashaw Bay, and the basin between Bashaw Bay and Foreleg Bay.

Twenty species of birds that were not seen during point counts were detected during other activities on the lake in 2007 (Appendix 1). These included eight species that were migrating to or from the breeding grounds to the north, 11 "possible" breeders, and one "probable" breeder (Western Kingbird). All but five of these species are considered to be of "Secure" status, with the remainder being two "Sensitive" species (Turkey Vulture and Swainson's Hawk), two species of "Undetermined" status (Short-billed Dowitcher and Yellow Rail), and one "Exotic/Alien" (Ring-necked Pheasant).

The distribution of seven species of mammals and three species of amphibians encountered during point-count surveys are shown in Figure 4. Our surveys were not designed to survey these animals, so observations are not necessarily representative of their actual distribution or abundance around the lake. However, the distributions of Beaver (*Castor canadensis*) and Muskrat (*Ondatra zibethicus*) are likely quite accurate, with these species being found in relatively undisturbed areas of the lake. All species of mammal and amphibian that we

Figure 2. Distribution and abundance of 30 "Sensitive" species detected during point counts on Buffalo Lake in 2007.



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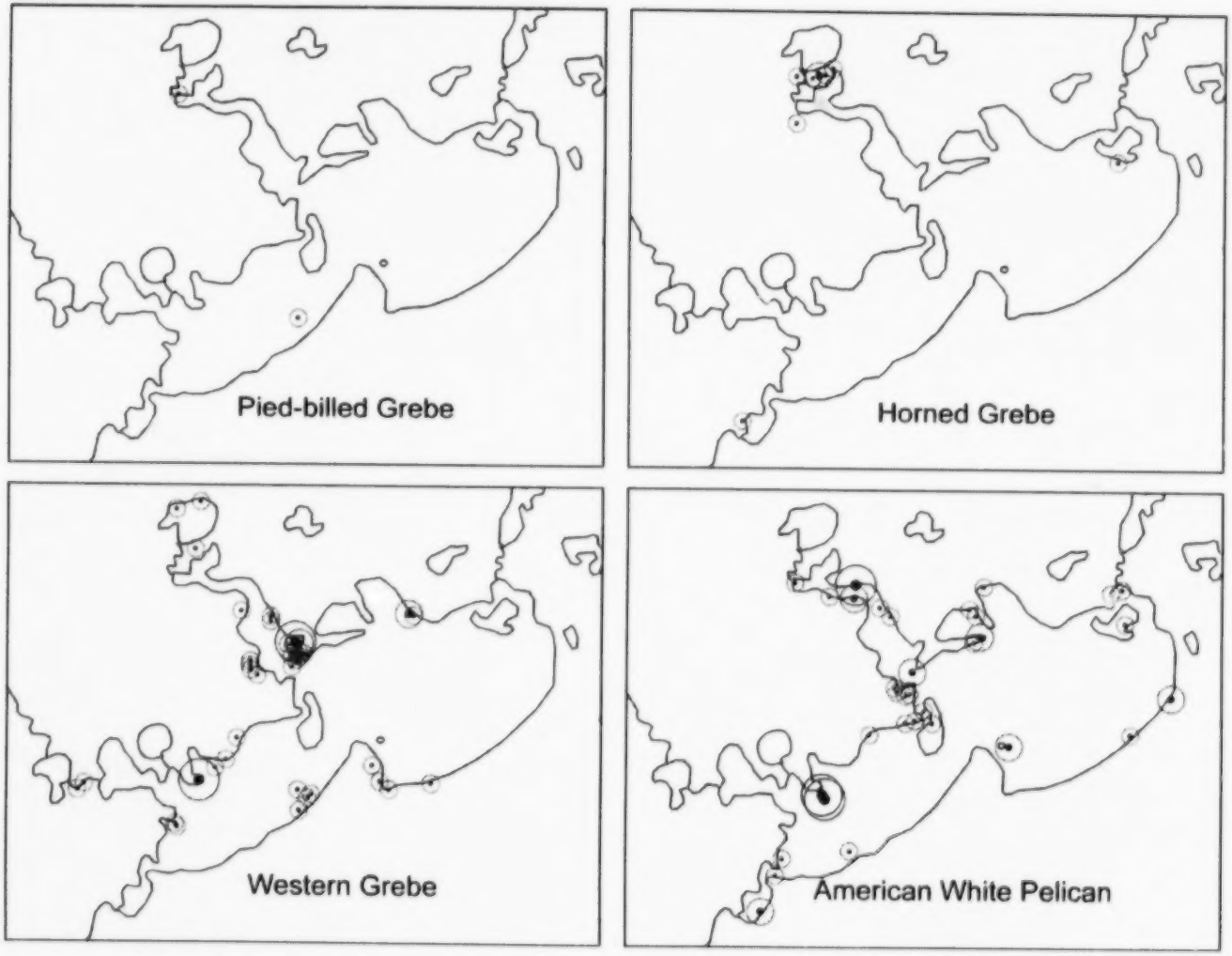

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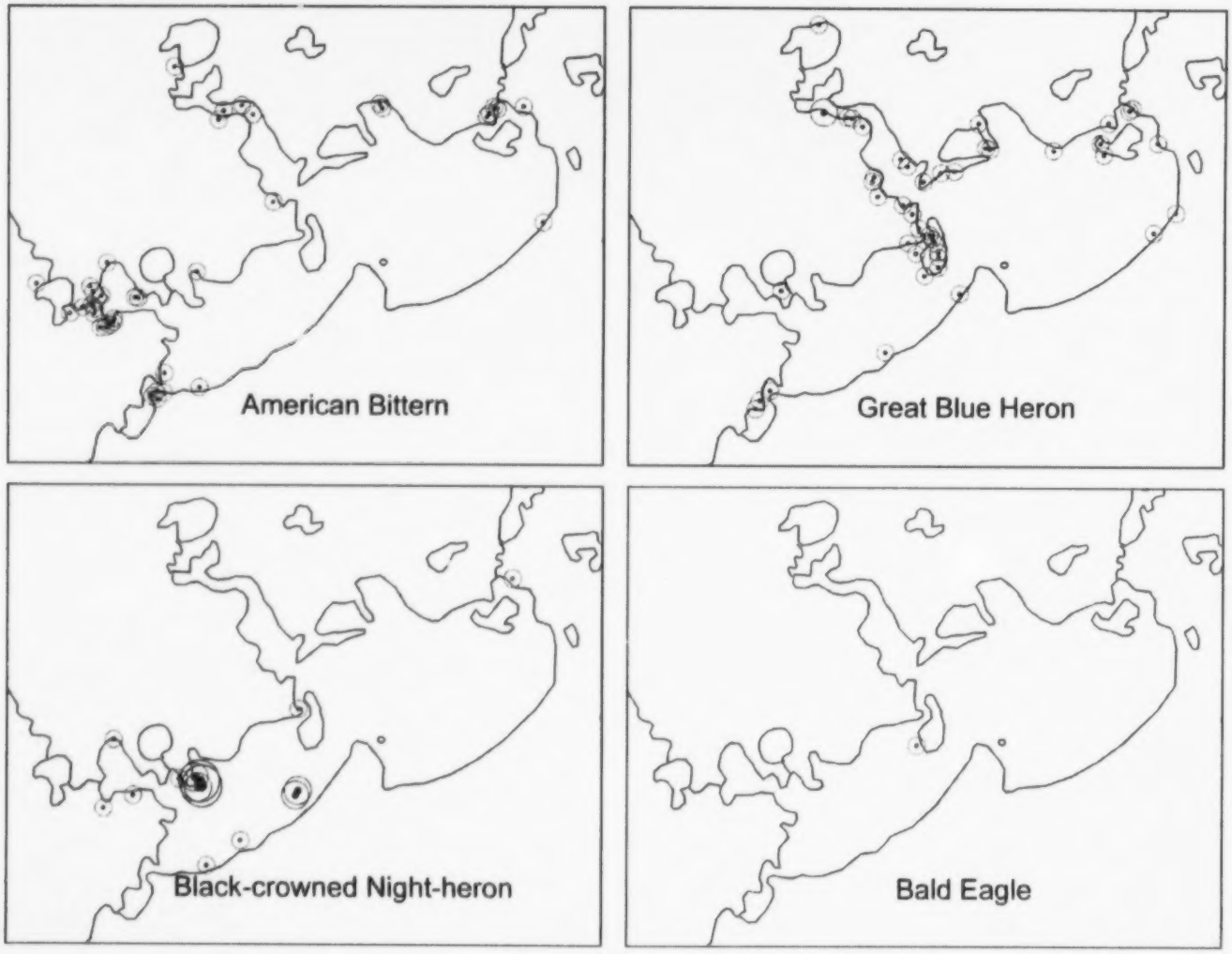

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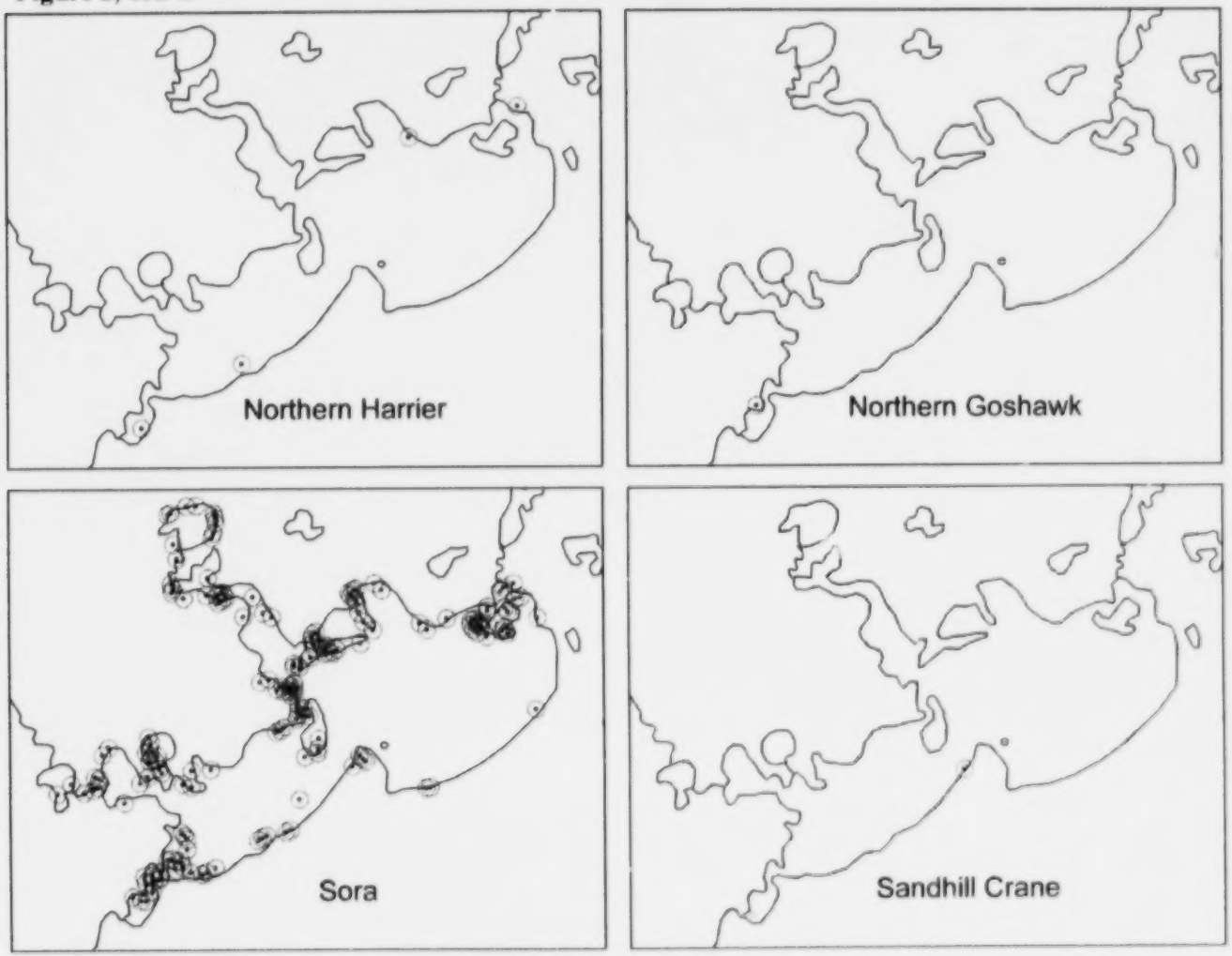

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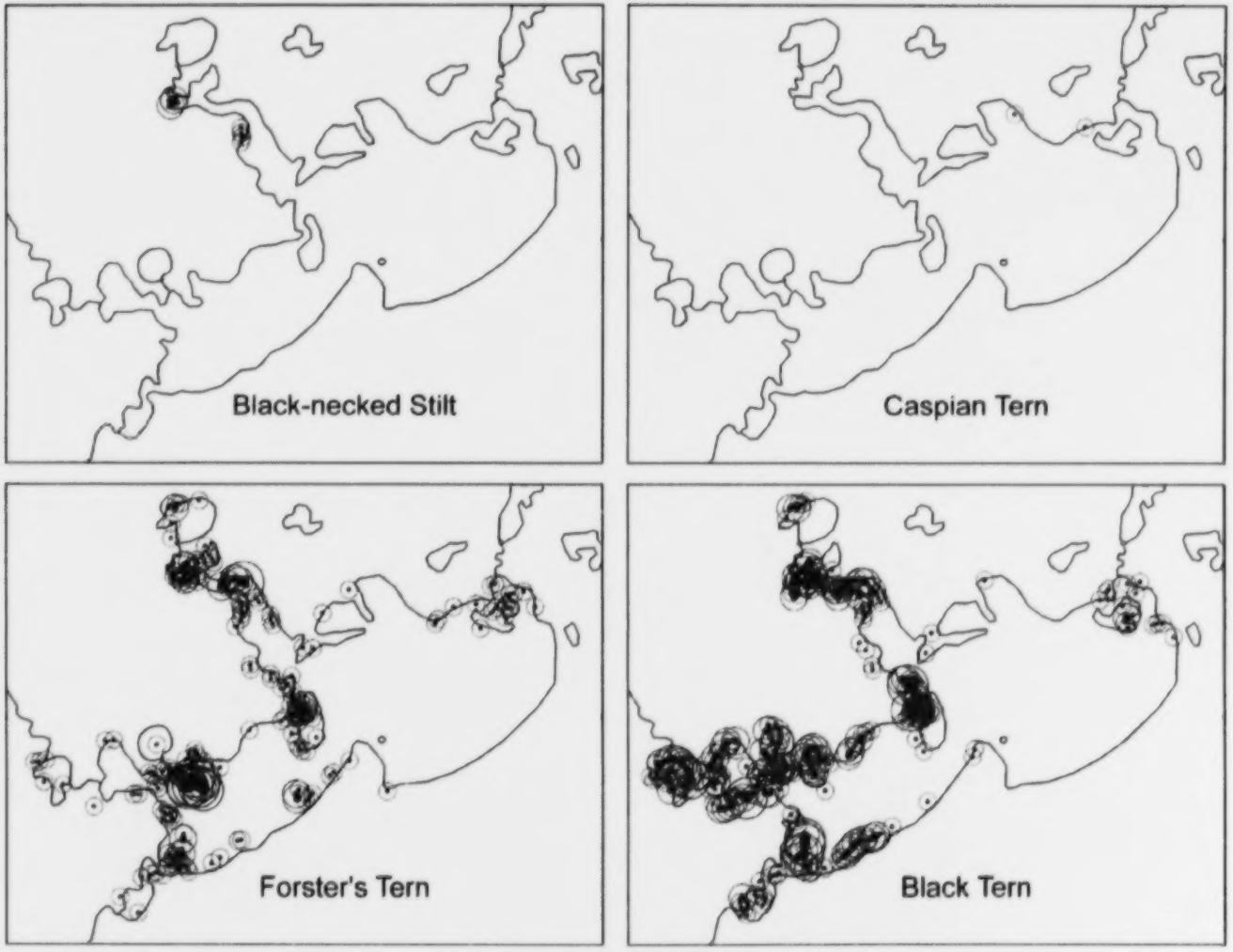

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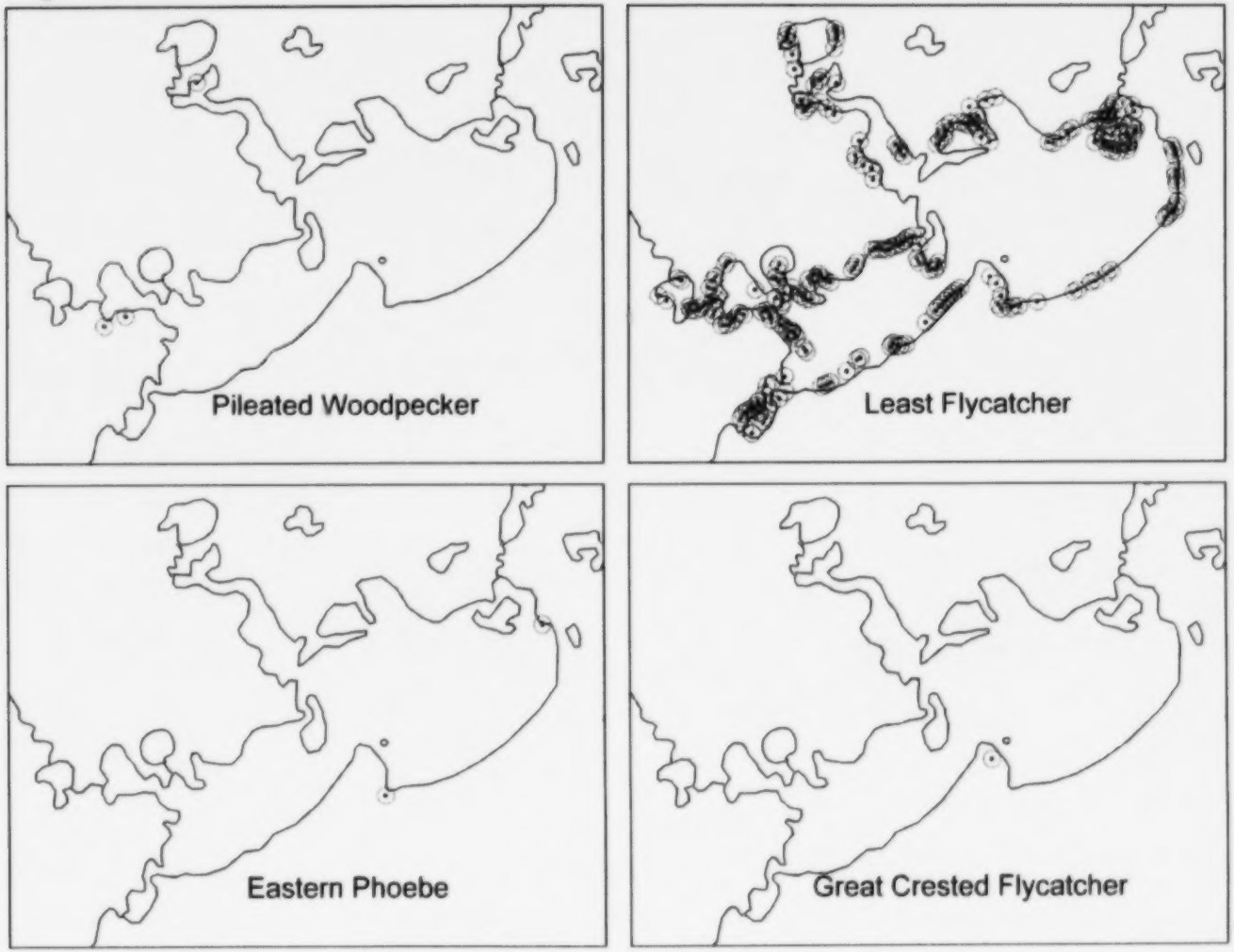

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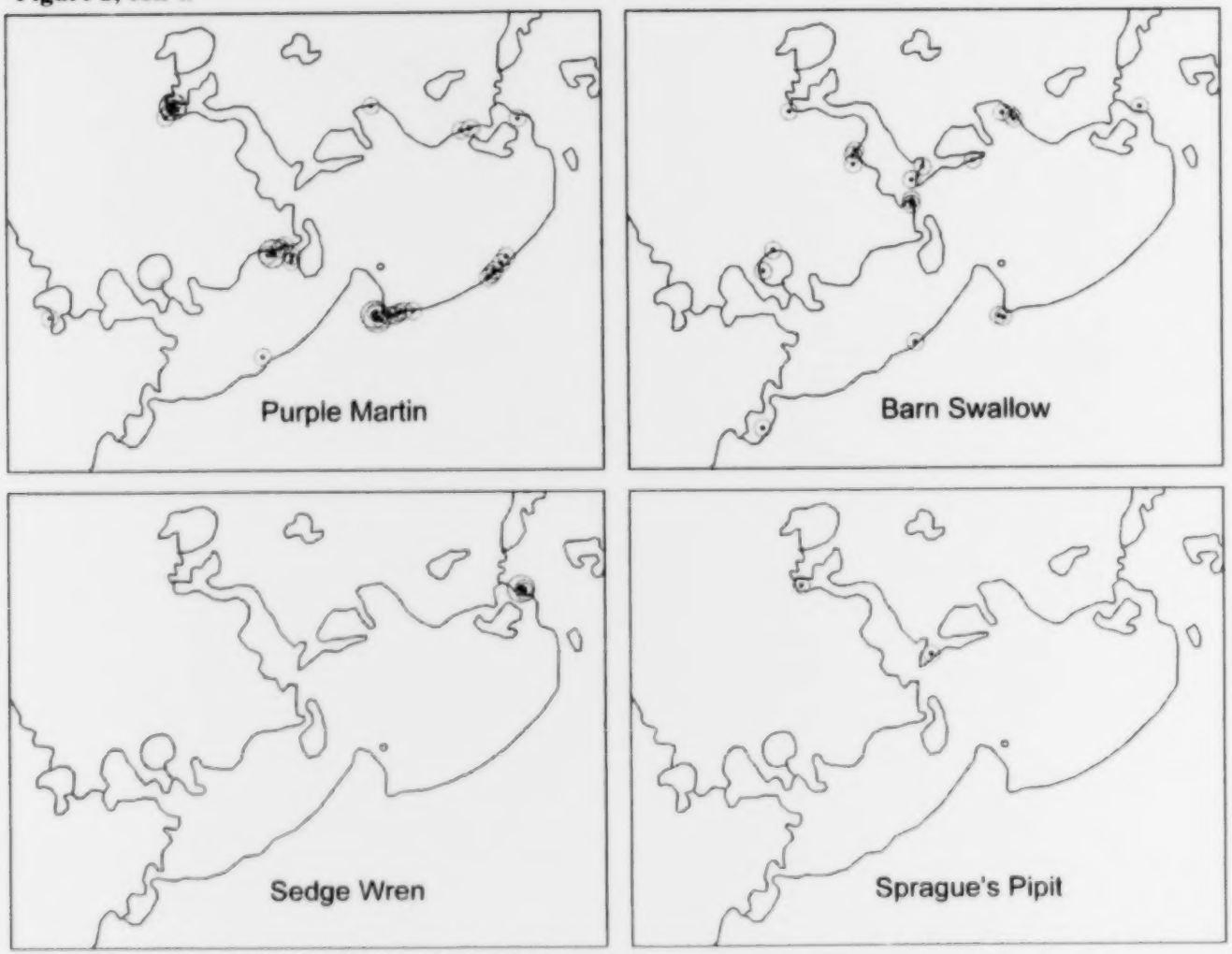

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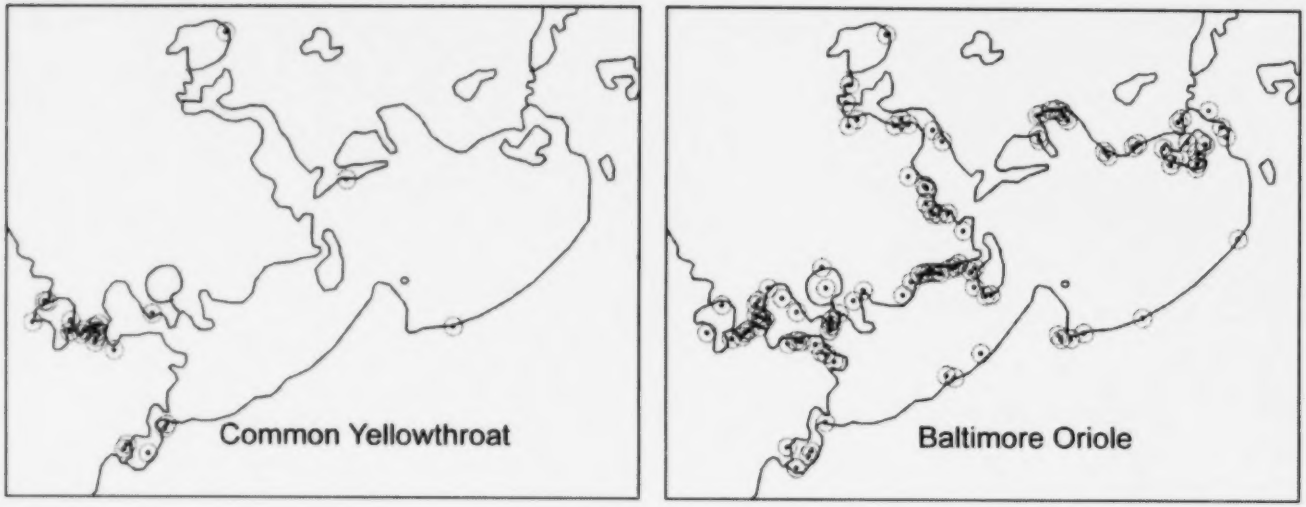
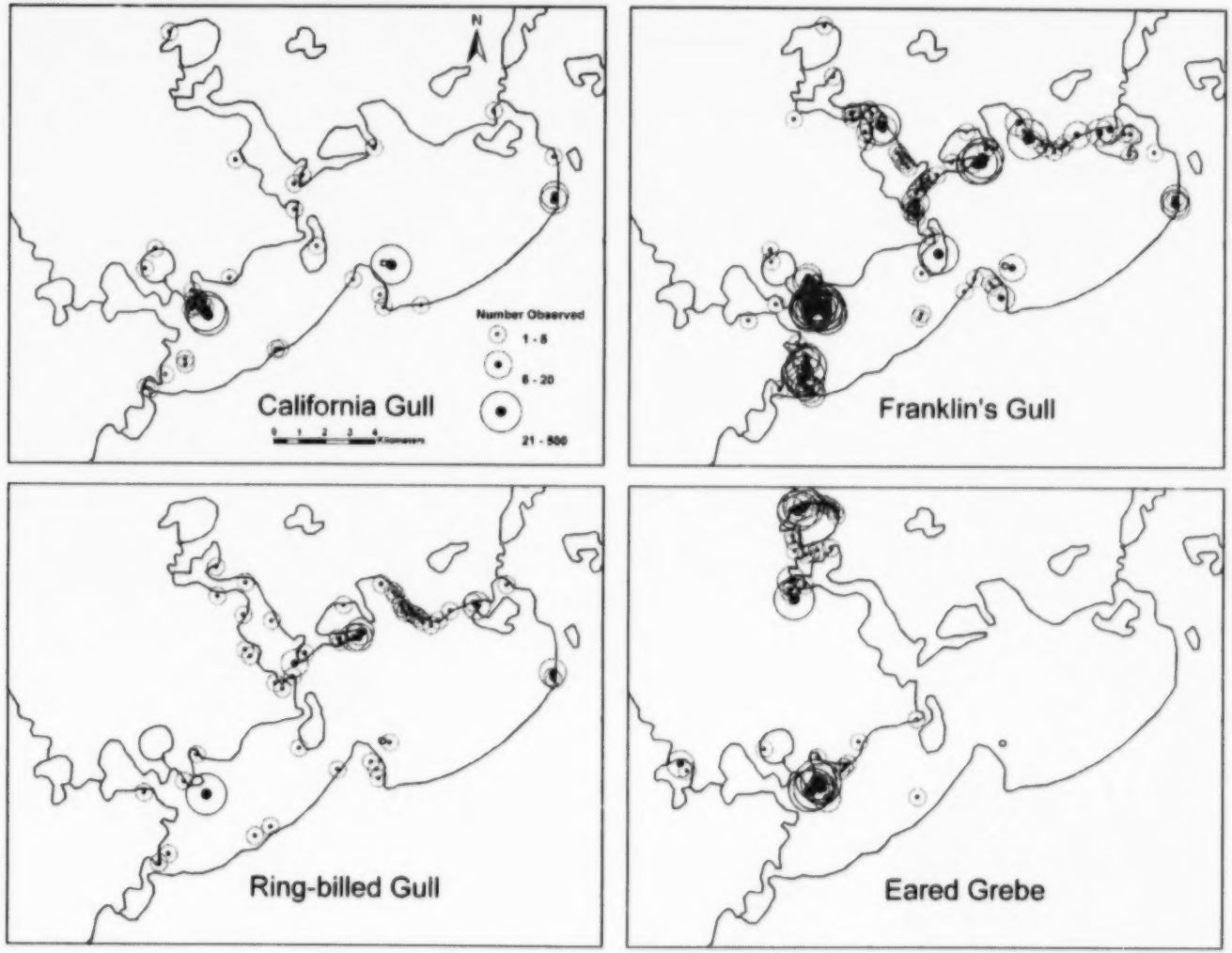


Figure 3. Distribution and abundance of six colonial waterbird species currently of "Secure" status in Alberta.



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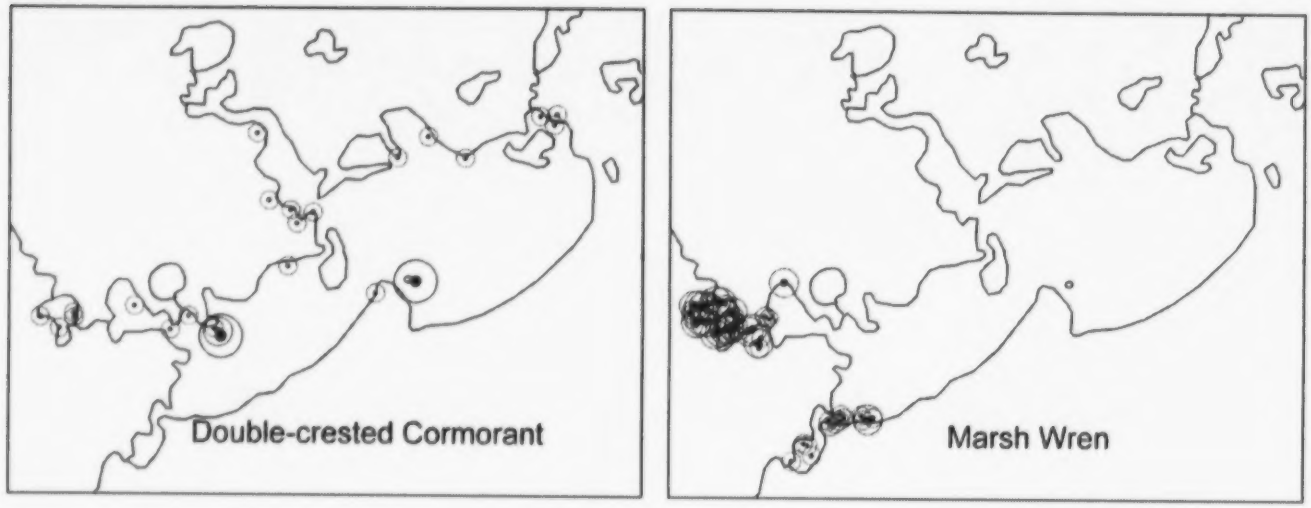
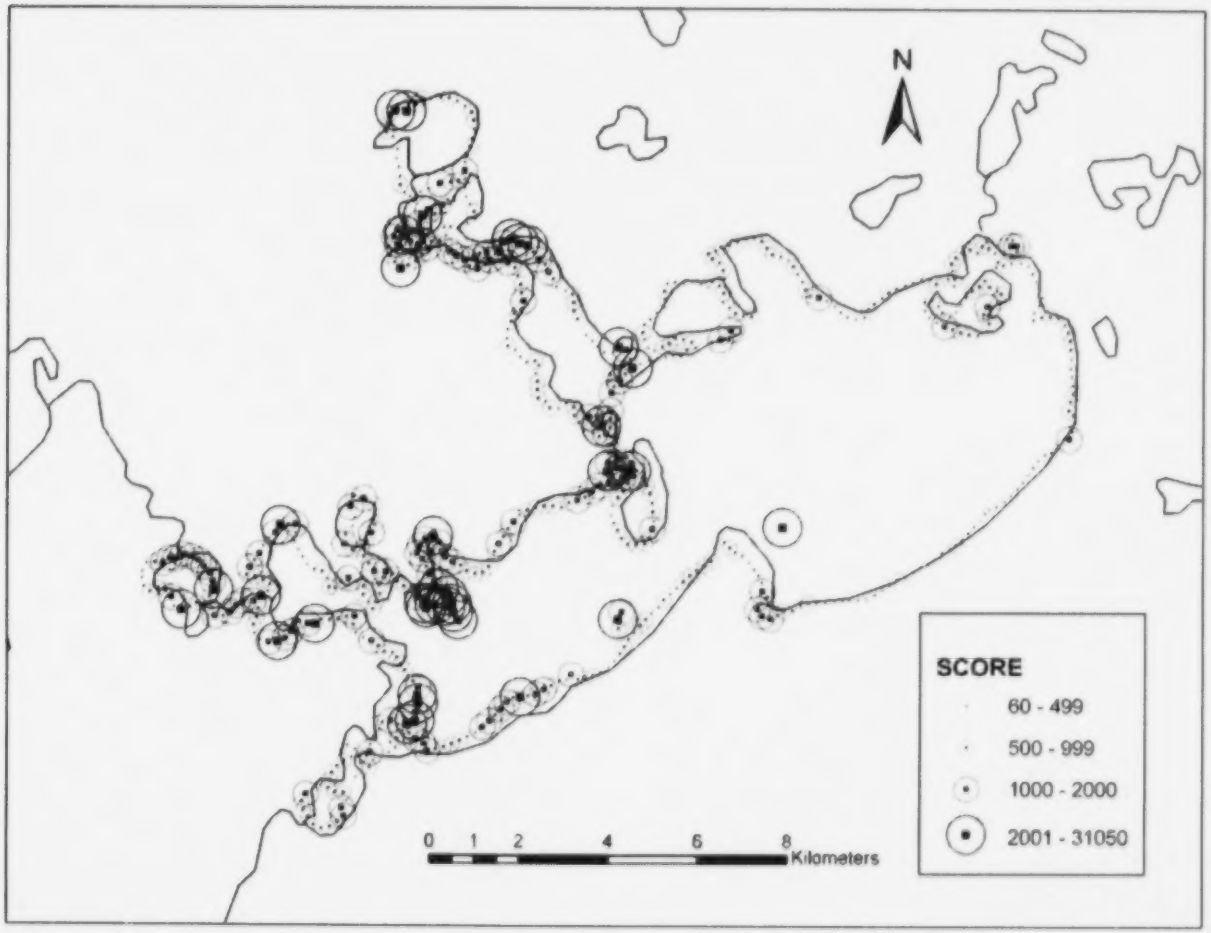


Figure 4. Point count scores for the shoreline of Buffalo Lake in 2007. Scores were based on the types and abundance of bird species detected in counts, as well as their risk of extirpation in the province (see text).



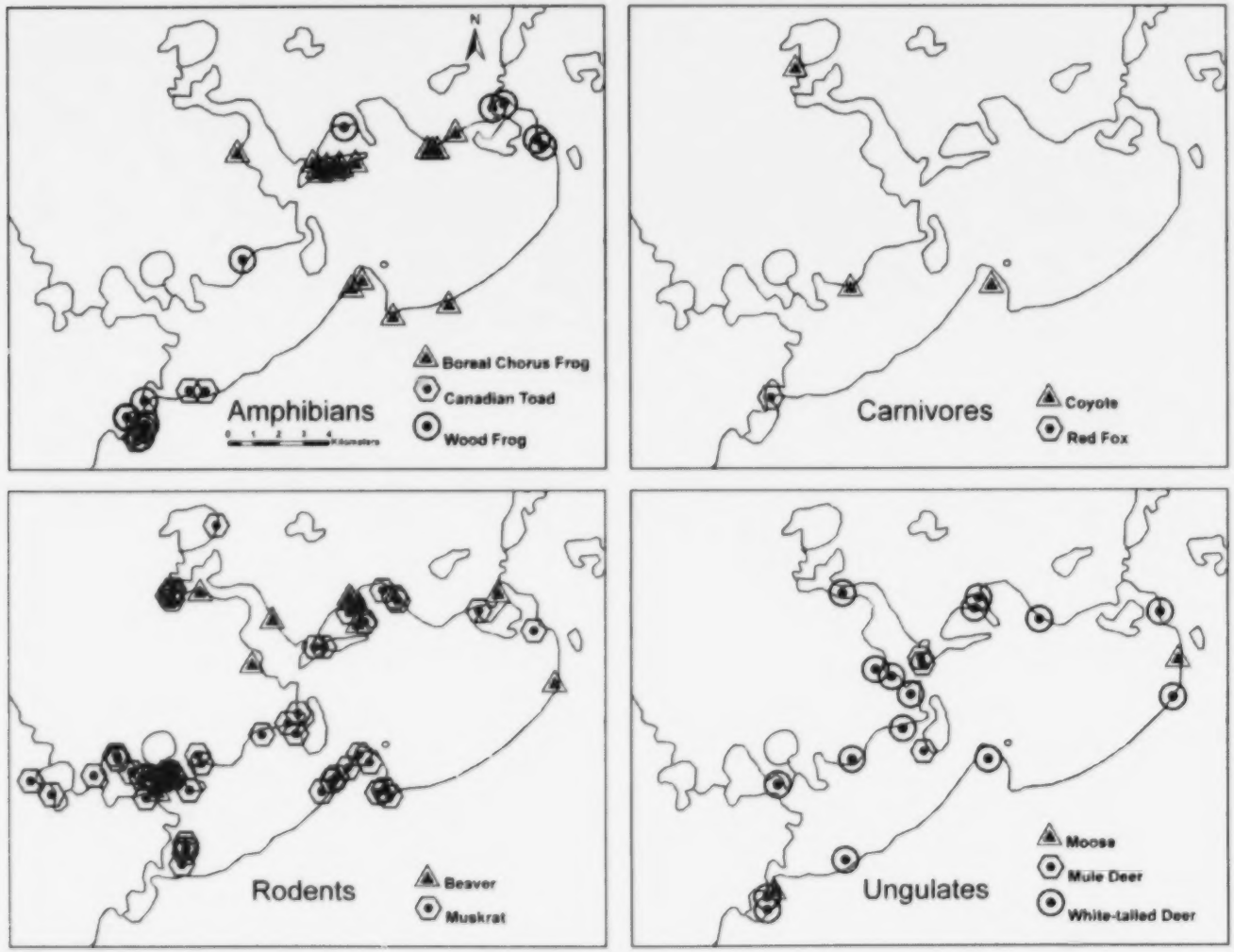
encountered are "Secure" species in Alberta, with the exception of the Canadian Toad. This species, which is currently listed as a "May Be At Risk" species (Alberta Sustainable Resource Development 2007), has disappeared from many areas of Alberta in recent years (Hamilton et al. 1998, Alberta Sustainable Resource Development 2007). Several observations of Canadian Toads were made along Tail Creek and adjacent parts of Buffalo Lake during bird surveys in 2007 (Figure 5). Up to 100 young-of-the year were seen along Tail Creek during amphibian studies in July (Prescott, unpubl. data).

DISCUSSION

Our results confirm Buffalo Lake to be a regionally significant lake for aquatic, semi-aquatic and land birds. In total, we tallied 145 species on and around the lake during the breeding season, including 137 species that are at least potential breeders. This total is higher total than recorded during extensive surveys by Gray et al. (1992), who tallied 122 species during the breeding and migration periods, including approximately 101 species that would be expected to breed in the area. Also significant is the occurrence of 30 "Sensitive" species, many of which are colonial nesters. For many of these species, Buffalo Lake supports the largest populations in central Alberta. The lake is undoubtedly of high importance outside of the breeding season as well. As examples, Gray et al. (1992) recorded 20 species of migrant shorebirds during relatively infrequent surveys in a single year. The lake is also known to support large concentrations of staging waterfowl (Poston et al. 1990, Gray et al. 1992), and upland areas around the lake provide a diversity of habitats to support migratory and wintering land birds. Over the course of a single year, more than 200 species of birds would be expected to use the habitats around Buffalo Lake.

During 2007, Buffalo Lake experienced the highest water levels since the stabilization project was completed in 1995 (D. Neis, pers. comm.). From descriptions in previous reports, water was significantly higher than during surveys by Bjorge (1992), Gray et al. (1992), Potter et al. (2003) and between 2004 and 2006 (Prescott, unpubl. data). This resulted in high numbers of birds that prefer wet meadow and shallow emergent habitats (e.g. Wilson's Snipe, Black-necked Stilt, Wilson's Phalarope, Black Tern, Red-necked Grebe and American Bittern), and lower abundance of species that occupy exposed shorelines or rocky islands (e.g. Spotted Sandpiper, Killdeer, Common Tern). Eared Grebes were far rarer in 2007 than they were in 2002 (Potter et al. 2003), or between 2004 and 2006 (Prescott, unpubl. data), with populations in 2007 being largely restricted to four relatively small colonies located in Parlby Bay, Bashaw Bay, the northwestern side of Secondary Bay, and the basin between Bashaw Bay and Foreleg Bay (Figure 3). The high water levels in 2007 may have caused the relocation of several waterbird colonies relative to the position occupied during the past few years. For example, a large colony of White Pelicans, Double-crested Cormorant, and Ring-billed Gulls occupying Bird Island for the past few years was much smaller in 2007, with the majority of birds moving to a newly formed island (formerly a peninsula) on the northwestern shore of

Figure 5. Distribution of amphibians and mammals encountered during bird surveys on Buffalo Lake during 2007.



Secondary Bay. The major Franklin's Gull colony shifted from the emergent vegetation offshore of Scenic Sands (Potter et al. 2003) to near the outlet of Tail Creek, and to the northwest side of Secondary Bay in 2007 (Figure 3). Other significant waterbird colonies appeared to be unaffected by higher water levels. For example, the colony of Black-crowned Night-Herons has occupied the same location in the emergent vegetation offshore from Scenic Sands during varying water conditions (Bjorge 1992, Potter et al. 2003; this study). Two provincially significant colonies of the Western Grebe have been in the same location since at least 2002 (Potter et al. 2003, Berg et al. 2004, Prescott, unpubl. data) and the colony of Great Blue Herons (currently about 55 nests) on the Pelican island has been in place for over 35 years (Allen 1987, Bjorge 1992).

It should be noted that high water levels temporarily eliminated habitat for the endangered Piping Plover (*Charadrius melodus*) on areas adjacent to Buffalo Lake (Rider Lake and Rockeling Bay) where they have nested in recent years (Alberta Piping Plover Recovery Team 2006). Recession of water levels in future years will undoubtedly create unvegetated shorelines to support plover populations. Lower water levels may prompt the return of Piping Plovers to Buffalo Lake itself in the next few years. The species has not been reported on the lake since 1989 (Goossen et al 2000, Alberta Fish and Wildlife, unpubl. data), although suitable substrates occur on several portions of the lake but have been covered by vegetation for the last decade or more. The presence of this endangered species will be a significant addition to the avifauna of Buffalo Lake, and will have implications for the protection of certain shorelines on the lake.

Our analysis of priority areas for conservation identified the following sites: western parts of Secondary Bay, Parlby Bay and the Narrows, the emergent vegetation offshore from Scenic Sands, Bird Island, the entrance and north end of Foreleg Bay, Bashaw Bay and the basin between Bashaw Bay and Foreleg Bay. The atypical water levels mean that shoreline values calculated from work in 2007 will not be identical to values calculated during years when water levels were much lower. Even so, our determination of priority areas is remarkably similar to the conclusions of Gray et al. (1992) who conducted surveys prior to stabilization, and apparently under much lower water conditions. These authors listed several "critical areas" for protection, based not only on breeding waterbirds, but also migrant waterfowl and shorebirds, rare plants, and other wildlife species. These areas included Bashaw Bay, Tail Creek and Tail Bay (presumably the outlet of Buffalo Lake at Tail Creek), the Narrows, several islands where colonial waterbirds occur, Parlby Bay, Hindleg Bay and Foreleg Bay[1]. The similarity in priority areas derived from different methodologies and during vastly different water levels lends weight to these areas being of high conservation value under a broad range of conditions.

The areas identified as high priorities for conservation are generally areas with extensive emergent vegetation, and relatively remote and undisturbed by human activity. It is hoped that land-use planning exercises underway on Buffalo Lake will include protective measures for these areas of significant avian value. Such measures could include: zoning areas for development based on sensitivity of shorelines; establishing speed limits and

[1] Gray et al. (1992) also cited Rider Lake, Rockeling Bay and Spotted Lake as "critical areas" (see Figure 1 for locations). These sites were not included in the survey area in 2007.

restricted areas for boaters and all-terrain vehicle users; increasing the awareness of residents and other lake users about sensitive areas; and the establishment of seasonal sanctuaries to exclude human disturbance during the nesting season. Such a sanctuary is currently in place on Bird Island, but this protected area includes only a single sensitive species (American White Pelican), and most individuals of this species nested away from Bird Island in 2007. The existing sanctuary offers no protection for any of the other sensitive species identified on the lake. Perhaps the most significant of these species currently occurring on the lake is the Western Grebe. The species has recently been declared to be a species of "Special Concern" in Alberta, and will be re-evaluated in the next two years for possible reclassification as a "Threatened" species under Alberta's Wildlife Act. When approving the current designation in January 2007, the Minister of Sustainable Resource Development declared that all known colonies of Western Grebes in Alberta be afforded immediate protection. Given this, the establishment of seasonal sanctuaries, which are designated under Alberta's Wildlife Act, should be strongly considered for parts of Buffalo Lake that support Western Grebes, and perhaps other species. Protection of the major colony on the northwestern shore of Secondary Bay (Figure 2) would also include protection for many other colonial species, including Black and Forster's Terns, Black-crowned Night-Herons, American White Pelicans, California, Ring-billed and Franklin's Gulls, Eared Grebes and Double-crested Cormorants.

Our surveys on Buffalo Lake considered only breeding birds during a single season. A more complete evaluation of priority wildlife habitats would include inventories of birds at other times of the year, during different years, and would also include proper consideration of other wildlife groups, including fish, invertebrates and plants. Many of these species are of high importance to resource managers because of their conservation status, and because of their value to humans. Proper consideration of these groups will help ensure that Buffalo Lake will continue to support essential wildlife habitats in the face of accelerating human development.

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Appendix 1. List of species encountered during shoreline surveys on Buffalo Lake during 2007. Values for % Counts, Total Counted and Mean Abundance are for species recorded during point counts (n=687) along the lakeshore. Species with missing values were incidental sightings during related activities on, or within 2 km of, the lake. Nomenclature and list order follows American Ornithologists' Union (1998).

Species	Risk Status[1]	% Counts	Total Counted	Mean Abundance (± SE)	Breeding Evidence[2]
Canada Goose *(Branta canadensis)*	Secure	3.49	73	0.11	Confirmed
Wood Duck *(Aix sponsa)*	Secure	0.15	1	0.001	Possible
Gadwall *(Anas strepera)*	Secure	24.16	381	0.55	Confirmed
American Wigeon *(Anas americana)*	Secure	4.08	53	0.08	Confirmed
Mallard *(Anas platyrhynchos)*	Secure	34.79	740	1.08	Confirmed
Blue-winged Teal *(Anas discors)*	Secure	38.43	787	1.15	Confirmed
Cinnamon Teal *(Anas cyanoptera)*	Secure	1.31	15	0.02	Probable
Northern Shoveler *(Anas clypeata)*	Secure	10.77	166	0.24	Confirmed
Northern Pintail *(Anas acuta)*	Sensitive	3.35	37	0.05	Probable
Green-winged Teal *(Anas crecca)*	Secure	7.86	92	0.13	Probable
Canvasback *(Aythya valisineria)*	Secure	4.95	114	0.17	Confirmed
Redhead *(Aythya americana)*	Secure	8.59	176	0.26	Confirmed
Ring-necked Duck *(Aythya collaris)*	Secure	0.15	1	0.001	Probable
Lesser Scaup *(Aythya affinis)*	Sensitive	7.86	142	0.21	Confirmed
White-winged Scoter *(Melanitta fusca)*	Sensitive	3.20	78	0.11	Confirmed
Bufflehead *(Bucephala albeola)*	Secure	5.24	115	0.17	Confirmed
Common Goldeneye *(Bucephala clangula)*	Secure	8.30	220	0.32	Confirmed
Hooded Merganser *(Lophodytes cucullatus)*	Secure	0.15	1	0.001	Possible
Common Merganser *(Mergus merganser)*	Secure	0.15	1	0.001	Confirmed
Ruddy Duck *(Oxyura jamaicensis)*	Secure	8.44	159	0.23	Confirmed
Ring-necked Pheasant *(Phasianus colchicus)*	Exotic/Alien				Possible
Ruffed Grouse *(Bonasa umbellus)*	Secure	0.15	1	0.001	Probable
Common Loon *(Gavia immer)*	Secure	2.04	18	0.03	Confirmed
Pied-billed Grebe *(Podilymbus podiceps)*	Sensitive	0.29	2	0.003	Possible
Horned Grebe *(Podiceps auritus)*	Sensitive	1.16	31	0.05	Confirmed
Red-necked Grebe *(Podiceps grisegena)*	Secure	37.99	671	0.98	Confirmed
Eared Grebe *(Podiceps nigricollis)*	Secure	5.97	744	1.08	Confirmed
Western Grebe *(Aechmophorus occidentalis)*	Sensitive	5.53	222	0.32	Confirmed
American White Pelican *(Pelecanus erythrorhynchos)*	Sensitive	4.80	551	0.80	Confirmed
Double-crested Cormorant *(Phalacrocorax auritus)*	Secure	3.49	128	0.19	Confirmed
American Bittern *(Botaurus lentiginosus)*	Sensitive	5.53	43	0.06	Probable
Great Blue Heron *(Ardea herodias)*	Sensitive	6.40	60	0.09	Confirmed
Black-crowned Night-Heron *(Nycticorax nycticorax)*	Sensitive	2.04	99	0.14	Confirmed

Appendix 1, con't.

Species	Risk Status[1]	% Counts	Total Counted	Mean Abundance (± SE)	Breeding Evidence[2]
Turkey Vulture *(Cathartes aura)*	Sensitive				Possible
Bald Eagle *(Haliaeetus leucocephalus)*	Sensitive	0.15	2	0.003	Confirmed
Northern Harrier*(Circus cyaneus)*	Sensitive	0.58	6	0.01	Probable
Sharp-shinned Hawk *(Accipiter striatus)*	Secure	0.15	2	0.003	Possible
Cooper's Hawk *(Accipiter cooperii)*	Secure				Possible
Northern Goshawk *(Accipiter gentilis)*	Sensitive	0.15	1	0.001	Possible
Swainson's Hawk *(Buteo swainsoni)*	Sensitive				Possible
Red-tailed Hawk *(Buteo jamaicensis)*	Secure	4.37	39	0.06	Confirmed
American Kestrel *(Falco sparverius)*	Secure				Possible
Merlin *(Falco columbarius)*	Secure				Possible
Yellow Rail *(Coturnicops noveboracensis)*	Undetermined				Possible
Sora *(Porzana carolina)*	Sensitive	24.31	198	0.29	Confirmed
American Coot *(Fulica americana)*	Secure	60.55	820	1.19	Confirmed
Sandhill Crane *(Grus canadensis)*	Sensitive	0.15	2	0.003	Probable
Killdeer *(Charadrius vociferus)*	Secure	7.28	75	0.11	Confirmed
Black-necked Stilt *(Himantopus mexicanus)*	Sensitive	1.16	31	0.05	Confirmed
American Avocet *(Recurvirostra americana)*	Secure	1.46	20	0.03	Confirmed
Spotted Sandpiper *(Actitis macularius)*	Secure	4.66	50	0.07	Confirmed
Greater Yellowlegs *(Tringa melanoleuca)*	Secure				Migrant
Willet *(Tringa semipalmata)*	Secure	1.16	10	0.01	Probable
Lesser Yellowlegs *(Tringa flavipes)*	Secure	3.49	50	0.07	Confirmed
Marbled Godwit (*Limosa fedoa*)	Secure	1.75	15	0.05	Confirmed
Sanderling *(Calidris alba)*	Secure				Migrant
Semipalmated Sandpiper *(Calidris pusilla)*	Secure				Migrant
Western Sandpiper *(Calidris mauri)*	Secure				Migrant
Least Sandpiper *(Calidris minutilla)*	Secure				Migrant
Pectoral Sandpiper *(Calidris melanotos)*	Secure				Migrant
Short-billed Dowitcher *(Limnodromus griseus)*	Undetermined				Migrant
Wilson's Snipe *(Gallinago delicata)*	Secure	21.40	190	0.28	Confirmed
Wilson's Phalarope *(Phalaropus tricolor)*	Secure	9.17	181	0.26	Confirmed
Franklin's Gull *(Larus pipixcan)*	Secure	15.14	1358	1.98	Confirmed
Bonaparte's Gull *(Larus philadelphia)*	Secure				Migrant
Ring-billed Gull *(Larus delawarensis)*	Secure	7.42	201	0.29	Confirmed
California Gull *(Larus californicus)*	Secure	5.24	1204	1.75	Confirmed
Herring Gull *(Larus argentatus)*	Secure	0.44	4	0.01	Possible
Caspian Tern *(Hydroprogne caspia)*	Sensitive	0.29	2	0.003	Possible
Black Tern *(Chlidonias niger)*	Sensitive	37.55	1399	2.04	Confirmed
Common Tern *(Sterna hirundo)*	Secure	1.89	44	0.06	Possible

Appendix 1, con't.

Species	Risk Status[1]	% Counts	Total Counted	Mean Abundance (± SE)	Breeding Evidence[2]
Forster's Tern *(Sterna forsteri)*	Sensitive	25.91	786	1.14	Confirmed
Rock Pigeon *(Columba livia)*	Exotic/Alien	0.44	9	0.01	Confirmed
Mourning Dove *(Zenaida macroura)*	Secure	0.15	1	0.001	Possible
Great Horned Owl *(Bubo virginianus)*	Secure	0.15	1	0.001	Possible
Ruby-throated Hummingbird *(Archilochus colubris)*	Secure	0.44	3	0.004	Possible
Yellow-bellied Sapsucker *(Sphyrapicus varius)*	Secure	0.44	3	0.004	Possible
Downy Woodpecker *(Picoides pubescens)*	Secure	0.73	5	0.01	Possible
Hairy Woodpecker *(Picoides villosus)*	Secure	0.15	1	0.001	Possible
Northern Flicker *(Colaptes auratus)*	Secure	1.89	14	0.02	Confirmed
Pileated Woodpecker *(Dryocopus pileatus)*	Sensitive	0.44	3	0.004	Possible
Olive-sided Flycatcher *(Contupus cooperi)*	Secure	0.15	1	0.001	Possible
Western Wood-Pewee *(Contopus sordidulus)*	Secure	0.29	2	0.003	Probable
Alder Flycatcher *(Empidonax alnorum)*	Secure	12.81	129	0.19	Confirmed
Least Flycatcher *(Empidonax minimus)*	Sensitive	32.61	353	0.51	Confirmed
Eastern Phoebe *(Sayornis phoebe)*	Sensitive	0.29	3	0.004	Possible
Great Crested Flycatcher *(Myiarchus crinitus)*	Sensitive	0.15	1	0.001	Possible
Western Kingbird *(Tyrannus verticalis)*	Secure				Probable
Eastern Kingbird *(Tyrannus tyrannus)*	Secure	8.88	77	0.11	Confirmed
Warbling Vireo *(Vireo gilvus)*	Secure	22.71	184	0.27	Probable
Philadelphia Vireo *(Vireo philadelphicus)*	Secure	0.15	2	0.003	Possible
Red-eyed Vireo *(Vireo olivaceus)*	Secure	12.23	95	0.14	Probable
Blue Jay *(Cyanocitta cristata)*	Secure				Possible
Black-billed Magpie *(Pica hudsonia)*	Secure	6.99	75	0.11	Confirmed
American Crow *(Corvus brachyrhynchos)*	Secure	28.38	341	0.50	Confirmed
Common Raven *(Corvus corax)*	Secure	2.18	21	0.03	Confirmed
Horned Lark *(Eremophila alpestris)*	Secure				Possible
Purple Martin *(Progne subis)*	Sensitive	4.66	90	0.13	Confirmed
Tree Swallow *(Tachycineta bicolor)*	Secure	35.66	538	0.78	Confirmed
Bank Swallow *(Riparia riparia)*	Secure	1.46	44	0.06	Confirmed
Cliff Swallow *(Petrochelidon pyrrhonota)*	Secure	0.87	22	0.03	Confirmed
Barn Swallow *(Hirundo rustica)*	Sensitive	2.77	33	0.05	Confirmed
Black-capped Chickadee *(Poecile atricapillus)*	Secure	4.95	44	0.06	Probable
Boreal Chickadee *(Poecile hudsonica)*	Secure				Possible
House Wren *(Troglodytes aedon)*	Secure	48.47	626	0.91	Confirmed
Sedge Wren *(Cistothorus platensis)*	Sensitive	0.44	15	0.02	Possible
Marsh Wren *(Cistothorus palustris)*	Secure	6.70	230	0.33	Confirmed
Mountain Bluebird *(Sialia currucoides)*	Secure	0.44	4	0.01	Confirmed
Veery *(Catharus fuscescens)*	Secure	0.15	1	0.001	Possible

Appendix 1, con't.

Species	Risk Status[1]	% Counts	Total Counted	Mean Abundance (± SE)	Breeding Evidence[2]
Swainson's Thrush *(Catharus ustulatus)*	Secure	0.29	4	0.01	Possible
Hermit Thrush *(Catharus guttatus)*	Secure	0.87	7	0.01	Probable
American Robin *(Turdus migratorius)*	Secure	21.40	206	0.30	Confirmed
Gray Catbird *(Dumetella carolinensis)*	Secure	5.24	38	0.06	Probable
European Starling *(Sturnus vulgaris)*	Exotic/Alien	8.15	311	0.45	Confirmed
Sprague's Pipit *(Anthus spragueii)*	Sensitive	0.29	2	0.003	Possible
Cedar Waxwing *(Bombycilla cedrorum)*	Secure	7.28	85	0.12	Probable
Tennessee Warbler *(Vermivora peregrina)*	Secure	0.29	3	0.004	Probable
Yellow Warbler *(Dendroica petechia)*	Secure	48.03	529	0.77	Confirmed
Yellow-rumped Warbler *(Dendroica coronata)*	Secure	0.29	2	0.003	Possible
American Redstart *(Setophaga ruticilla)*	Secure	0.73	6	0.01	Possible
Ovenbird *(Seiurus aurocapilla)*	Secure				Possible
Common Yellowthroat *(Geothlypis trichas)*	Sensitive	3.20	36	0.05	Probable
Spotted Towhee *(Pipilo maculatus)*	Secure	0.15	1	0.001	Possible
Chipping Sparrow *(Spizella passerina)*	Secure	1.46	14	0.02	Probable
Clay-colored Sparrow *(Spizella pallida)*	Secure	59.53	760	1.11	Confirmed
Vesper Sparrow *(Pooecetes gramineus)*	Secure	6.84	57	0.08	Probable
Savannah Sparrow *(Passerculus sandwichensis)*	Secure	55.31	819	1.19	Confirmed
Le Conte's Sparrow *(Ammodramus leconteii)*	Secure	11.50	118	0.17	Confirmed
Nelson's Sharp-tailed Sparrow *(Ammodramus nelsoni)*	Secure	2.04	18	0.03	Probable
Song Sparrow *(Melospiza melodia)*	Secure	8.73	73	0.11	Probable
Lincoln's Sparrow *(Melospiza lincolnii)*	Secure	0.15	1	0.001	Probable
White-throated Sparrow *(Zonotrichia albicollis)*	Secure	3.78	28	0.04	Probable
Dark-eyed Junco *(Junco hyemalis)*	Secure	0.15	1	0.001	Possible
Rose-breasted Grosbeak *(Pheucticus ludovicianus)*	Secure	2.33	23	0.03	Probable
Red-winged Blackbird *(Agelaius phoeniceus)*	Secure	66.08	1508	2.20	Confirmed
Western Meadowlark *(Sturnella neglecta)*	Secure	0.87	7	0.01	Probable
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*	Secure	39.01	949	1.38	Confirmed
Brewer's Blackbird *(Euphagus cyanocephalus)*	Secure	3.64	123	0.08	Confirmed
Common Grackle *(Quiscalus quiscula)*	Secure	0.15	1	0.001	Possible
Brown-headed Cowbird *(Molothrus ater)*	Secure	20.23	233	0.34	Confirmed
Baltimore Oriole *(Icterus galbula)*	Sensitive	15.14	118	0.17	Confirmed
Purple Finch *(Carpodacus purpureus)*	Secure	0.15	1	0.001	Possible
Pine Siskin *(Carduelis pinus)*	Secure	0.15	1	0.001	Possible
American Goldfinch *(Carduelis tristis)*	Secure	8.44	72	0.10	Confirmed
House Sparrow *(Passer domesticus)*	Exotic/Alien	2.18	48	0.07	Confirmed

[1] Following Alberta Sustainable Resource Development 2007
[2] Following Semenchuk 1992

List of Titles in This Series

(as of November 2007)

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No. 13 Northern leopard frog reintroduction. Raven River - Year 2 (2000), by K. Kendell. (2001)

No. 14 Cumulative effects of watershed disturbances on fish communities in the Kakwa and Simonette watersheds. The Northern Watershed Project. Study 3 Progress report, by T. Thera and A. Wildeman. (2001)

No. 15 Harlequin duck research in Kananaskis Country in 2000, by C.M. Smith. (2001)

No. 16 Proposed monitoring plan for harlequin ducks in the Bow Region of Alberta, by C.M. Smith. (2001)

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